TED01 – (Environmental Part 01) Air Pollution

Name _____

Option E: Environmental chemistry (15/22 hours)

Human activities involve intensive use of limited resources found in air, water and soil. Many of these activities produce waste products that build up in the environment to produce pollution with increasingly local and global effects. An understanding of this impact is essential within and beyond the study of chemistry. This option has many opportunities for discussing aim 8 issues and the international dimension.

Core material: E1–E8 are core material for SL and HL (15 hours).

Extension material: E9–E12 are extension material for HL only (7 hours).

1. E.1.1 Describe the main sources of carbon monoxide (CO), oxides of nitrogen (NOx), oxides of sulfur (SOx), particulates and volatile organic compounds (VOCs) in the atmosphere. (2) *Include both natural and anthropogenic sources. Equations should be used as appropriate.*
    a. What is pollution?

    b. Describe the four layers of the atmosphere:

    c. What is the composition of the atmosphere?

    d. What does the term anthropogenic mean?

    e. What is a source and a sink?

    f. List several pollutants and their source (both man-made and natural)

Compound	Natural Source	Man-made Sources

2. E.1.2 Evaluate current methods for the reduction of air pollution. (3) *Examples include: CO - catalytic converters, NOx - control of fuel/air ratio SOx—alkaline scrubbing, limestone-based fluidized beds, particulates - electrostatic precipitationi, VOC's - catalytic converters*
    a. How does a combustion engine work?

    b. Provide the equations for combustion:

Amount of Oxygen Present	Situation, oxygen content %, cause, result, etc	Appropriate Equations
Excess O_2 - lean		
Complete combustion		

Limited O_2 - rich		
Very limited O_2 – poorly designed automobile		

c. What does the "three way" mean when referring to the catalytic converter?

d. Explain how a catalytic converter works (provide a diagram and appropriate equations):

e. Explain the difference between primary and secondary pollutants

f. Sulfur is a pungent smelling toxic gas that damages the respiratory system and may lead to asthma attacks. It is also highly soluble in water and contributes to the formation of acid rain. Outline the process (including equations) for the production of sulphuric acid from sulphur emissions.
   i. Sulfur is present in small amounts in coal, during combustion of coal, this happens to sulphur
   ii. Reacts with water
   iii. Photochemical oxidation occurs in water droplets (catalysed by soot, etc)
   iv. Sulphur trioxe reacts with water to produce sulphuric acid

g. How can SO_2 emissions be reduced?
   i. Refined to remove sulphur
   ii. Fluidized Bed Combustion (FBC)
   iii. Flue Gas Desulfurization (FGD)

h. Complete the following table with information regarding various particulate emissions

Type of Particulate Emission	Relevant information / equations
Metal Particles	
Metal Oxide Particles	
Fly Ash	
Asbestos Dust	
Organic Particles	
Aerosol Mist	

   i. How can particulates be removed? (there are two processes, briefly explain each)
   ii. What are the human health impacts of particulates in the air?